

**Hypersonic ReEntry Deployable Glider Experiment (HEDGE)**

(Technical Report)

**Ethical Analysis of Hypersonic Weapons Used in the Russo-Ukrainian War**

(STS Research Paper)

An Undergraduate Thesis

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## **Sociotechnical Synthesis**

Hypersonic is the ability to travel at or faster than 5 times the speed of sound, around 3700 mph or 6000 kmph. This capability is being harnessed and used in a new release of modern weapons. These hypersonic weapons are championed by their fast speeds, maneuverability, and low flying altitudes. These weapons were created by countries that were locked from using their nuclear capabilities because of Mutually Assured Destruction. However, research to advance the technical capabilities is limited by the difficulty of recreating a hypersonic environment in a laboratory. Thus, my technical project is focused on creating a hypersonic craft and collecting data from its launch. My STS research is centered around the capabilities of hypersonic weaponry and their effects on the existing MAD architecture.

The project code-named HEDGE (Hypersonic ReEntry Deployable Glider Experiment) aims to have a glide-body be released in Low-Earth Orbit, glide in the atmosphere at hypersonic speeds, and ultimately burn up during reentry. The mission objectives are to show the feasibility of CubeSats in hypersonic flight and to transmit flight data observed from the glide-body back to ground stations. HEDGE consists of six subsystems: Program Management, Communications (ground and space segments), Software and Avionics, Power Thermal & Environmental, Altitude Determination and Control Systems (ADACS) and Orbits, and Structures and Integration (S&I). HEDGE also utilizes the help of four rising Electrical Engineering majors. The following prospectus outlines the significance, objectives, resources, and future of this design, specifically related to the S&I subteam of the HEDGE CubeSat design.

In my STS research, I investigated the introduction of hypersonic weapons and how they challenge the current system of warfare. I explore the two main types of hypersonic weapons: Hypersonic Cruise Vehicle (HCV), and Hypersonic Glide Vehicles (HGV). I found that though these weapons were created to target defense systems, their capabilities are far more profound

than intended and could threaten MAD. As for researching the real-world impacts, these weapons were not used. The only exception is Russia, which used some of its hypersonic capabilities in the Russo-Ukrainian War. However, I found that these weapons have not lived up to their intended abilities and have fallen short. While they may not threaten the structure of MAD now, I found that other countries have hypersonic weapons that are more advanced than Russia's.

Thus more research must be conducted on hypersonic weapons and their vulnerabilities. My technical project will most likely be sponsored by the U.S. Navy and other private companies that are interested in hypersonic capabilities. In it, I go into the specifics of the structural integrity of the HEDGE, along with an in-depth analysis of the design layout. With the future continuing to be ever-challenging with the introduction of these weapons, I want to ensure these weapons are well-researched to understand their impact on current global security and policy.